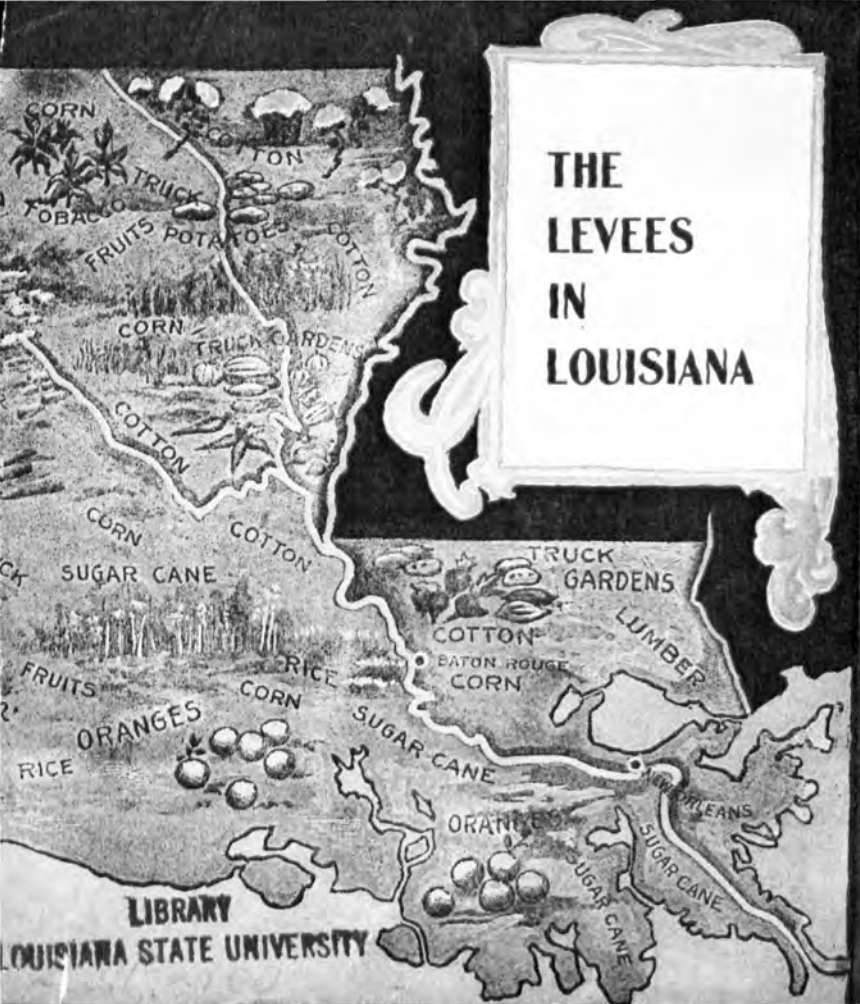


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Louisiana's Inundation

LOUISIANA STATE COMMISSION

OF

LOUISIANA PURCHASE EXPOSITION

ST. LOUIS, MO.

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Dr. WILLIAM CARTER STUBBS,
State Commissioner.

ROBERT GLENK,
Assistant to State Commissioner.

Don't fail to see the Louisiana State Building, a replica of the Cabildo, in which the transfer of Louisiana took place in 1803.

See also Louisiana's exhibit in the following buildings: Agriculture, Horticulture, Education, Forestry, Fish and Game, Mines and Minerals, Liberal Arts, Transportation and Anthropology.

THE STATE OF LOUISIANA IS MAKING THE FOLLOWING DISPLAY AT THE WORLD'S FAIR, ST. LOUIS:

1st. Louisiana State Building—An exact reproduction of the "Cabildo" of New Orleans in which the actual transfer of Louisiana from France to the United States on December 20th, 1803, took place. It is furnished throughout with furniture of the Empire and Colonial styles.

2nd. A grand display of agriculture in the Agricultural Palace, showing the products of the field and the machinery by which they are wrought into merchantable forms. A complete sugar house, a rice mill, an irrigation plant, cotton gins and presses, cotton seed oil mill, etc., are shown in perfect forms on a reduced scale. Forage and garden crops; tobacco (yellow leaf, cigar leaf and cigars, and the famous Perique in all of its forms); fibre plants and products; grains, grasses, clovers, alfalfa, etc., are shown in profusion.

3rd. A fine display of fruits and plants in the Horticultural Building—on the floor of the main building and in the conservatory. In this display will be found the best collection of the finest pecans grown.

4th. In the Forestry Building will be found all the trees of her forest, and the products manufactured from them.

5th. In the Forestry Building, but on a different space, will also be found all of the birds, fishes and wild animals of the State.

6th. In the Education Building will be found the school exhibits of the State, from the kindergarten to the universities.

7th. In the Mines and Minerals Building, the "Devil in sulphur," a "Pyramid in sulphur," Lot's Wife in salt, crude and refined petroleums, marbles, coal, etc., fresh from the mines of Louisiana, are exhibited.

8th. In the Liberal Arts Building will be found topographic maps of the levees of the State (35 ft. by 4 ft.), New Orleans of 1803 (2 ft. by 2 ft.), and New Orleans of 1903 (15 ft. by 15 ft.). Two hundred maps of the Gulf Coast from 1500 to the present time, some rare old books, and a working model of the great United States Dock in New Orleans.

9th. In the Transportation Building are illustrations of transportation on the Mississippi River, past and present, beginning with the Indian canoe and ending with the monster ocean liner of today.

10th. In the Anthropological Building is a fine collection of Indian relics, including a number of baskets of rare and beautiful types.

Descriptive pamphlets of each exhibit may be had on application. For fuller information of the State, apply at the Louisiana State Building for "Handbook of Louisiana." Louisiana has a fully equipped Department of Agriculture and Immigration, which will cheerfully supply any information desired.

Apply to MAJOR I. G. LEE, Commissioner of Agriculture and Immigration, Baton Rouge, La.

and your wants will be filled.

Levees.

THE within pamphlet has been prepared by Col. ARSENE PERILLIAT, a member of the Louisiana State Board of Engineers, and will convey to the reader a very accurate idea of the immensity of the Levee System and the immunity of the riparian dwellers from floods when protected by adequate Levees.

The Alluvial Valley of the Mississippi River and the Levee System Built to Protect it From Overflow.

The delta of the Mississippi River subject to overflow extends from Cape Girardeau, 45 miles above Cairo, to the Gulf of Mexico, nearly 600 miles in an air line, and varies in width from 20 to 80 miles. Its area amounts to 29,790 square miles.

It was formed in the geological ages of the past, by the sediment carried to the sea by the streams draining the basins tributary to the Mississippi River. This delta, of alluvial formation, which is now the richest and most fertile soil of the United States, was gradually elevated, so that it now stands above the ordinary floods that occur in the Mississippi River; but in times of extraordinary rainfall, and, therefore, of excessive floods, it is subject to overflow by the abnormal flood heights of the Mississippi River.

The Mississippi River which flows through this delta carries the drainage of 1,240,050 square miles, which is 41 per cent of the total area of the United States. This area drained extends from the Rockies to the Alleghanies and from Canada to the Gulf of Mexico. It covers 1,800 miles in longitude, and 1,500 miles in latitude. It drains ten entire States, parts of twenty-two other States and territories, besides a part of two provinces of Canada. The States entirely draining to the Mississippi River are Nebraska, Kansas, Oklahoma, Indian Territory, Missouri, Arkansas, Tennessee, Kentucky, Iowa and Illinois. The States draining in part to the Mississippi River are Montana, North Dakota, South Dakota, Wyoming, Idaho, Colorado, New Mexico, Texas, Louisiana, Mississippi, Alabama, Georgia, North Carolina, Virginia, West Virginia, Ohio, Pennsylvania, Maryland, New York, Indiana, Wisconsin and Minnesota. The area thus drained by the Mississippi River is as great as the combined area of Austria, Germany, France, Holland, Italy, Spain, Portugal, Norway and Great Britain.

Thousands of miles of streams and rivers carry this drainage to the Mississippi River, and of these 15,000 miles are navigable streams. The drainage area is subdivided into the following six basins, viz:

	Area. Square miles.
Basin of the Ohio River	201,700
Basin of the Upper Mississippi River	165,900
Basin of the Missouri River	527,150
Basin of the Arkansas River	186,300
Basin of the Red River	90,000
Central Basin of the Mississippi River	69,000
Total	1,240,050

The Mississippi River, flowing in a sinuous course

from Cape Girardeau to the Gulf of Mexico, a distance of 600 miles in an air line, has a length, owing to its sinuosities, of 1,115 miles. The average rainfall carried annually to the sea by the Mississippi River amounts approximately to seven hundred and eighty-five (785) billion cubic feet, or 159 cubic miles of water, and this is estimated as being only 25 per cent of the total rainfall over the basin, the remaining 75 per cent being lost either by evaporation, or else by absorption and percolation through the ground.

Every year, however, as the country becomes more open, better tilled, and therefore better drained, the volume of water finding its way to the Mississippi River increases and also reaches the river more rapidly, owing to the improved condition of drainage throughout the country, thereby swelling and increasing the intensity of the floods. Moreover, the period of heavy rainfall is limited to two or three of the Spring months of the year, and therefore this enormous volume of water drained, instead of being spread evenly throughout the year is carried to the sea in its enormous bulk during a short period of the year, thereby occasioning intense and excessive flood waves. This causes excessive fluctuations between the extreme low and high stages of water in the Mississippi River. The height of the fluctuations between extreme low and extreme high water is as follows at different points:

Cairo	53.2 feet
Memphis	42.7 "
Vicksburg	59.0 "
Mouth of Red River	50.8 "
Baton Rouge	40.2 "
New Orleans	19.9 "

A part of these fluctuations is contained within the natural banks of the river, but after these become submerged, the levee system is the only agency which protects the country from disastrous overflow, and in their present crude and incomplete condition the levees often give way, letting in the water over cultivated and fertile lands and causing widespread disaster. The damage is made greater from the fact that the lands of alluvial formation are highest on the banks of the stream. On the Mississippi River these banks slope away from the river at the rate of from three to twelve feet in the first mile, then at a diminishing rate until a distance of two to three miles from the river is attained, when the low level swamp is reached.

The Mississippi River, on its way from Cairo to the Gulf, first hugs the hills on the eastern edge of the alluvial basin from Cairo to Memphis, leaving to the westward the large St. Francis Basin, which is subject to overflow, and the area of which is 6,090 square miles.

From Memphis to Helena the river crosses the valley, reaching its western boundary hills at Helena. From Helena, Ark., to the Louisiana line it runs parallel to the western boundary hills, and from there crosses to

the eastward, reaching the eastern boundary hills at Vicksburg.

From Vicksburg, Miss., to Baton Rouge, La., it hugs the eastern boundary hills, and from Baton Rouge to the Gulf it runs through the center of the valley, leaving lands subject to overflow on both sides of its channel.

Between Memphis and Vicksburg, to the east of the river, is the rich Yazoo basin, subject to overflow, and embracing 6,648 square miles. Between Helena, Ark., and Arkansas City, on the west of the river, is the White River Basin, subject to overflow, and embracing 956 square miles. From Arkansas City to the Gulf, to the west of the river, are the Tensas, Atchafalaya and Lafourche basins, all highly populated and thoroughly cultivated for cotton and sugar, which are subject to overflow, and which embrace 13,064 square miles. Finally to the east of the river, from Baton Rouge, La., to the Gulf, are situated the rich Pontchartrain and Lake Borgne basins, within which is the City of New Orleans, all of which is subject to overflow, and covers 2,001 square miles. This is better understood by following the meanderings of the river on the map of the Mississippi River Commission.

These basins are of the richest alluvial land, and have been rapidly opening to cultivation. On the lower river, from the Louisiana State line to the Gulf, they have been settled for about one hundred and fifty years. They yield rich crops of cotton, rice and sugar, yielding more in dollars and cents per acre than any other lands in the United States. They frequently give as much as a bale and one-half of cotton to the acre, which represents a value of $75, while the sugar yield is even greater. Hence, the people have taxed themselves to the limit to keep away from their fields and homes the flood water due to the drainage of 41 per cent of the United States.

In order to do this, the people have sub-divided the above mentioned territory subject to overflow into some twenty Levee Districts, organized under the various State laws, and managed and operated by Boards of Commissioners, generally appointed by the Governors of the various States, although some of them are elected. The membership of these Boards varies from three to twenty-four members per Board.

The following table gives the names of the various Levee Districts of the Valley, their location, the number of members which compose them, the length of levee line built by them in each State, and the area partly protected, and eventually to be protected, by these levees:

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LOCAL NAME OF DISTRICT.	Commissioners on Board.		Length of levee line in miles.	Area to be eventually protected in square miles.	
Upper St. Francis..	?				
Lower St. Francis..	9	Missouri	85	2,874	
				65	Illinois
Reelfoot	?	Tennessee	24	453	
				125	Kentucky
St. Francis 24					
Red Fork 9					
Desha 3		Arkansas	357	4,562	
Chicot 3					
Upper Yazoo 12					
Lower Yazoo 6		Mississippi	312	6,926	
Tensas Basin 7					
Fifth Louisiana 8					
Atchafalaya 7					
Lafourche 9					
Buras 5		Louisiana	712	14,695	
Pontchartrain 9					
Orleans 9					
Lake Borgne 3					
Grand Prairie 5					
Total			1,490	29,790	

These Boards have by law the power of levying and collecting a tax to build levees, and this taxation takes all manner of form to bring as large a revenue as possible.

All the districts have an ad valorem tax on the assessed value of the property within their boundaries varying from 5 to 16 mills on the dollar, additionally they tax themselves from 2½ to 5 cents on each acre of land in the district. Also they levy a railroad tax varying from $5.00 to $100.00 per mile. Most of the districts tax every bale of cotton raised within their confines from 25 cents to $1.00. Every 1,000 pounds of sugar made within their territory is taxed from 25 to 50 cents. Every sack of rice, barrel of potatoes, of onions and oranges is taxed from 3 to 10 cents; in fact, all of the produce is taxed, even the oysters do not escape it, as they are taxed a certain sum per barrel, on the ground that the exclusion of fresh Mississippi River water from their beds is conducive to their health, and, therefore, to their taste.

In addition to this, these Levee Boards have issued large amounts of bonds, predicated on their revenues; and additionally in the State of Louisiana, prevails a tax of one mill for levee purposes on all of its State assessments, whether they be hill property above overflow or bottom lands subject to overflow.

The following table gives the rate and amount of taxation of the various levee districts of the valley, and the revenues derived therefrom, also the amount of bonds already issued for levee purposes:

Local Name of Levee District—	Amount of Bonds Outstanding.	Mill-Tax Rate Permitted. Mills.	Tax Per Acre. Cents.	Railroad Tax Per Mile.	Revenue from Produce Tax.	Gross Annual Revenues.
Reelfoot District, Tenn.	$ 100,000	5	..			
St. Francis District, Mo.		..	4	$30-$10		$ 6,000.00
St. Francis District, Ark.	750,000	..	4	$30-$10-$5	(a)	64,859.58
Yazoo Miss. Delta Dist., Miss.	1,074,000	11¼-15¾	5		(b)$6,543.60	321,819.45
Lower Miss. Dist., Miss.	1,150,000	5	5		(c)157,532.05	315,808.58
State of Louisiana General Engineer Fund		1	..			267,723.57
Atchafalaya Basin Dist., La.	850,000	10	2½	$60	75,585,12	262,699.18
Bossier District, La.	199,900	10	5	$60	6,988.74	25,734.24
Buras District, La.	25,000	10	5	$30	33,001.93	8,265.58
Caddo District, La.	199,800	10	5	$60	8,596.75	21,312.05
Fifth La. District, La.	460,000	10	5	$20-$30-$60	54,810.50	158,637.19
Grand Prairie District, La.	20,000	10	(e)	$30	552.78	2,540.43
Lafourche Basin District, La.	275,000	10	2½	$50-$100	50,578.57	171,338.05
Lake Borgne District, La.	100,000	10	5	$60	3,373.70	23,660.59
Orleans District, La.	325,000	1	(a)	(a)		138,702.84
Pontchartrain District, La.	786,000	10	3	$100	36,043.39	105,841.50
Red River, Atchafalaya and Bayou Boeuf Dist., La.	250,000	10	..	$60	(a)	53,514.90
Tensas Basin District, La.	90,500	10	5	$30-$60	(a)	12,479.22
	$6,655,200				$403,607.13	$1,960,936.95

(a) None Authorized.
(b) Privilege Tax.
(c) Cotton Tax One Dollar per Bale.
(d) None Assessed.
(e) One Dollar on each and every arpent front of land facing the Mississippi River. An arpent, approximately, five-sixths of an acre.

It has not been possible for me to secure the assessments of all the districts of the Valley, but the following table gives the assessment and revenues from all sources, for levee purposes, of some of the main districts of Louisiana, and shows the rate of taxation which those revenues represent when applied to the assessed value of the property. Each of these figures should be increased by one mill on the dollar, as these districts all pay the general one mill levee tax prevailing over the entire State.

Name of district.	Assessment.	Revenue.	Rate of taxation on the dollar.
Tensas	$3,155,000	$12,500	3.9 mills
Fifth Louisiana	5,847,000	158,600	27.1 "
Atchafalaya	15,656,000	262,700	16.8 "
Pontchartrain	6,119,000	105,800	17.3 "
Lafourche	10,516,000	171,300	16.2 "
Lake Borgne	1,669,000	23,600	14.1 "
Buras	419,000	8,300	19.8 "
Grand Prairie	182,000	2,500	13.7 "
City of New Orleans	138,700,000	138,700	1.0 "

It is seen from the above that the tax of most of the districts amount to over 1½ per cent, and in one case to as much as 2.8 per cent. Yet the people labor cheerfully under this load, glad to be immune from overflow seven years out of every ten, and hoping that the time will come when by persevering effort they will be entirely safe from the scourge of the waters of the Mississippi.

The table of revenues above further shows that besides the $6,655,200 of bonds already applied to levee work in the Mississippi River Valley, the districts derive from taxation about $1,961,000 annually. Of this it is safe to say that $1,500,000 is actually expended in earthwork, the balance being devoted to the payment of interest on bonds issued, and to the cost of administration and operation.

Prior to 1882, the United States Government contributed nothing to levee protection. After the great flood of 1882, the Mississippi River Commission spent some money on levee building under the theory that in order to obtain and maintain deep low water navigation, a confinement of the waters within the banks was necessary.

For many years following, the amount spent by the Government on levees was limited to such stretches as were deemed by the River Commission as falling under the above consideration. No money, however, could be spent for the express purpose of affording protection from overflow.

Four or five years ago Congress removed this objectionable clause from the Rivers and Harbors Bill, and allowed the River Commission to spend such money out of the appropriation, for the purpose of giving protection from overflow, as it deemed expedient. In accordance with this, the River Commission has allotted approximately $1,000,000 per annum to levee building.

This amount is effective less the sum to be deducted for the cost of administration, which is about 5 per cent, leaving about $950,000 to be expended in earthwork.

This help of the federal government has revived the hopes of the residents of the valley who had been reduced to despair by the great overflows of 1882, 1884 and 1890, and although the great flood waves of 1892, 1893, 1897 and 1903 have broken records of the past, and their own successive records, culminating in the great flood of this year, the amount of territory overflowed this year from breaks in the levees is only 10.7 per cent of the area of the valley, while in 1882 the entire valley was overflowed. Hence the alluvial residents have taken new heart, and are straining every effort to build their levees higher and stronger.

The 1,490 miles of levees on the Mississiipi River now contain about 167,238,000 cubic yards of earth. To complete them to the Mississippi River Commission grade will require approximately 94,054,000 cubic yards of earthwork. The estimated final contents of the levee line is 261,292,000 cubic yards. The line is therefore now built to 64 per cent of completion.

The standard adopted for this estimate, which is known as the Mississippi River Commission grade, is a standard of size and height for the levees which is estimated to be strong and high enough to withstand the largest flood which may pour into the Mississippi River. It is extremely difficult to make such an estimate, with any degree of accuracy, owing to the many functions which enter into the problem, yet this Commission grade was established by carefully considering all of the data on hand, and so far the indications are that it is not far from correct.

Another very important consideration enters into the work of levee building on the Mississippi River, and that is the constant shifting of the stream itself. The river runs through a bed of sand and silt of its own making and deposited by itself in ages past. This is more or less friable, and more or less subject to erosion by a strong current velocity. In the concave bends of the river the erosion or "caving," as it is called, is very great at flood periods, while on convex bends, the reverse occurs, and large accretions of soil, or "sand bars," as they are called, are deposited by the river dropping its silt. This erosion or caving occurs at a rate varying from nothing to as much as 2,000 feet per year. Unless the bank can be protected or revetted in some manner to stop this erosion, the levee is soon reached and caves into the stream. The only remedy then is to build the levee far enough back to give it a reasonable lifetime against the encroachment of the river. To this end levees are sometimes built as far as four miles from the stream. The land condemned by this operation, and which is therefore thrown outside of levee protection, is at the loss of the owner, as the laws permit the condemnation of lands for levee pur-

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poses without compensation to the owner. This hardship adds to the burden of the poor riparian owner, who sometimes has paid onerous levee taxes all of his life, and finally sees his entire plantation thrown outside of levee protection, and eventually engulfed into the river. Yet the residents of the valley of the Mississippi cheerfully pay their levee taxes, and will even contribute more if they can do so. It is estimated that three-fourths of one per cent of the levee line is destroyed annually by caving into the river.

In conclusion I will state, as a result of my experience of fifteen years in levee construction on the Mississippi River, that I believe a levee system can be constructed which will protect the Mississippi Valley from overflow. It is only a question of money, endeavor and time. The fertility of the soil, and the general resources and richness of the alluvial lands justify this great expenditure, and as a business proposition, the Mississippi Valley when thoroughly protected will be one of the most valuable assets of the United States. As it is now, only partially protected, it is the home and source of wealth of millions of our citizens. Every year floods of increasing intensity are poured upon it by the drainage of our country, yet the inhabitants of the valley struggle manfully against them. They clamor for assistance from the federal government to protect them from a scourge rendered more terrible each year by the development of the country, yet while hoping that this help will come sometime, in a measure commensurate with their needs and the disaster inflicted, they do not remain idle, but work to the full extent of their means and ability. They are entitled to the strong assistance of the federal government, and they trust that in due time it will be forthcoming.

LEVEES OF LOUISIANA.

A large portion of the State of Louisiana, amounting to 23,000 square miles, which is about one-half of the total area of the State, is of alluvial formation. By alluvial formation is meant that territory which was deposited in geological ages by the Mississippi River. It was slowly formed by the mighty river dropping the sediment which it carries to the sea; and this sediment thus deposited rising higher and higher and filling up the estuary which extended as far up as Cairo, became in the course of ages the richest agricultural ground in the United States. It has been often said that territory thus formed was the "cream of the soil of the United States."

This alluvial part of Louisiana, through which the Mississippi, Red and the Atchafalaya rivers flow in their onward course to the sea, is thickly settled and highly cultivated; but at the time of flood in these rivers the extreme high water which they carry to the sea would overflow this alluvial territory were it not for the arti-

ficial embankments, or levees, as they are called, which line the sides of these streams. The earliest settlers in the State of Louisiana first occupied the highest spots in these valleys, spots which were rarely overflowed and only by extreme high waters. Even then, at times, they found it necessary to surround their properties by artificial embankments or levees, in order to protect themselves from overflows at times of extreme flood period. Little by little, as the country became more settled, additional alluvial territory was occupied by civilization, and these levees had to be extended along the banks of the streams.

At first the levees were built by the riparian inhabitants themselves and at their own expense. In the course of time, however, the State appropriated money for the construction of levees, and later on, the alluvial territory was divided, by legislative enactments, into levee districts, which taxed themselves varying amounts in order to maintain these levees. Finally, the United States Government, recognizing that the levee system was necessary to improve and maintain the navigability of the Mississippi River, devoted a certain amount of money annually to the construction of levees.

At present the levee line by which the State of Louisiana is protected from overflow is about 1,430 miles long. Of this 815 miles is situated on the Mississippi River, 395 miles on Red River and tributaries, 70 miles on the Atchafalaya River and 150 miles on Bayou Lafourche.

The State of Louisiana levies, for levee purposes, a one-mill tax on all assessed property within its boundaries, whether it be situated on alluvial land subject to overflow, or hill lands above overflow. This yields approximately $315,000 a year. In addition, the alluvial territory has been subdivided into 15 levee districts, which, by local taxation, raise a revenue of approximately $1,000,000 a year for levee building. This revenue is raised first, by an ad valorem tax on the assessed value of the property, which is generally ten mills on the dollar; second, by a land tax, which is generally 2½ cents per acre; third, by a produce tax levied on cotton, sugar, sugar cane, molasses, potatoes, onions, rice, and even oysters; fourth, by a tax on every railroad, varying from $20 to $100 per mile. In addition to this, the various levee districts have the right to issue bonds, the proceeds of which are devoted to levee building, and the total authorized issue of which amounts to $4,999,000. The United States Government, through the Mississippi River Commission, has been disbursing about $700,000 per year for the last three or four years in levee building on the Mississippi River.

These taxes, high as they may seem, are easily and cheerfully met by the residents of the alluvial portion of the State of Louisiana. The planters find their levee

tax is a cheap insurance against the floods which formerly use to inundate their crops; and moreover, the productiveness of the alluvial lands of the State of Louisiana is so great, and the returns yielded by agricultural products raised on these fertile lands so far exceed in value those obtained from the less productive hill lands, that this tax, or insurance, is considered cheap and easily met.

The levee system, although not yet complete, either in extent or in size, has substantially and practically protected the State of Louisiana from overflows since 1893, and the day is not far distant when its completion will insure full protection to the inhabitants of that most fertile section of the State.



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